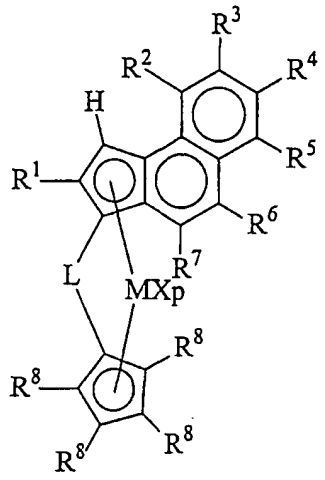
Claims

1. A metallocene compound of formula (I):



(I)

wherein:

M is an atom of a transition metal selected from those belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

X, same or different, is a hydrogen atom, a halogen atom, or a R, OR, OSO_2CF_3, OCOR, SR, NR_2 or PR_2 group, wherein R is a C_1-C_{40} hydrocarbon group optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a OR'O group wherein R' is a divalent radical selected from C_1-C_{40} alkylidene, C_6-C_{40} arylidene, C_7-C_{40} alkylarylidene and C_7-C_{40} arylalkylidene radicals;

L is a divalent bridging group selected from C_1-C_{20} alkylidene, C_3-C_{20} cycloalkylidene, C_6-C_{20} arylidene, C_7-C_{20} alkylarylidene, or C_7-C_{20} arylalkylidene radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, and a silylidene radical containing up to 5 silicon atoms;

R^1 is a C_1-C_{40} hydrocarbon group optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^3 is a C_1-C_{40} hydrocarbon group optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^2, R^4 and R^5, equal to or different from each other, are hydrogen atoms or C_1-C_{40} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; with the proviso that least one among R^2, R^4 and R^5 is a hydrogen atom;

R^3 with R^4 and/or R^4 with R^5 can also join to form a aliphatic or aromatic 3-7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; said ring can bear one or more hydrocarbon substituents having from 1 to 20 carbon atoms;

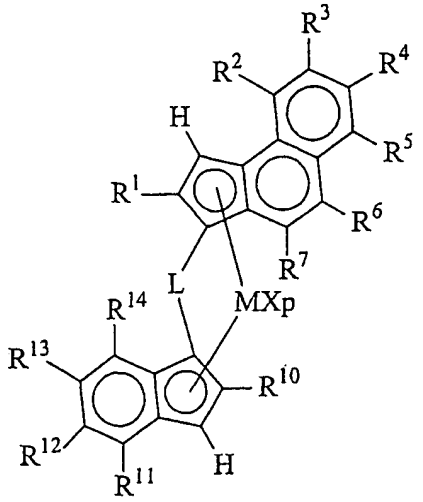
R^6 and R^7, equal to or different from each other, are hydrogen atoms or C_1-C_{40} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^8, equal to or different from each other, are hydrogen atoms or C_1-C_{50} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; two or more R^8 groups can also join together to form one or more 3-7 membered ring said rings contain at least one heteroatom belonging to groups 13-16 of the Periodic Table of the Elements; said rings can be further substituted with C_1-C_{20} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements.

2. The metallocene compound of formula (I) according to claim 1 wherein M is titanium, zirconium or hafnium; p is 2; R is a linear or branched, cyclic or acyclic, C_1-C_{40}-alkyl, C_2-C_{40} alkenyl, C_2-C_{40} alkynyl, C_6-C_{40}-aryl, C_7-C_{40}-alkylaryl or C_7-C_{40}-arylalkyl radicals; optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; X is a hydrogen atom, a halogen atom or a R group; L is a group $Z(R'')_2$ wherein Z is a carbon or a silicon atom, and R" is a linear or branched, cyclic or acyclic, C_1-C_{10}-alkyl, C_2-C_{10} alkenyl, C_2-C_{10} alkynyl, C_6-C_{10}-aryl, C_7-C_{10}-alkylaryl or C_7-C_{10}-arylalkyl radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

3. The metallocene compound of formula (I) according to claims 1 or 2 wherein R^1 is a linear or branched, saturated or unsaturated C_1-C_{20}-alkyl radical; R^3 is a linear or branched, saturated or unsaturated C_1-C_{20}-alkyl or a C_6-C_{40}-aryl, radical; R^2, R^4 and R^5 are hydrogen atoms; and R^6 and R^7 are hydrogen atoms or linear or branched, saturated or unsaturated C_1-C_{20}-alkyl radicals.

4. The metallocene compound according to anyone of claims 1-3 having formula (II)



(II)

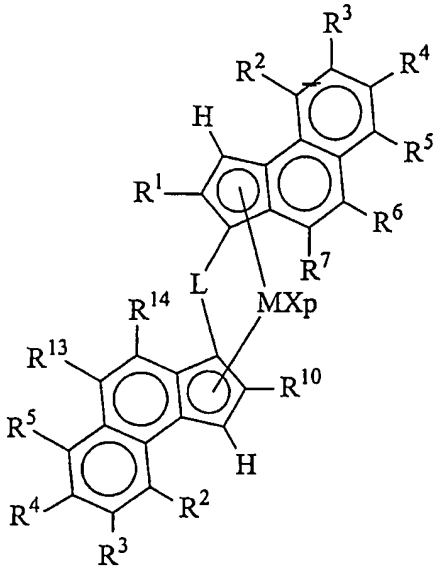
wherein M, X, p, L R^1, R^2, R^3, R^4, R^5, R^6 and R^7 have the meaning described in claims 1-3;

R^{10} is, a hydrogen atom or C_1-C_{40} hydrocarbon group optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^{11}, R^{12}, R^{13} and R^{14}, equal to or different from each other, are hydrogen atoms or C_1-C_{40} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; two adjacent R^{11}, R^{12}, R^{13} and R^{14} groups can also join to form a 3-7 membered ring optionally containing heteroatoms belonging to groups 13-16 of the Periodic Table of the Elements; said ring can bear one or more hydrocarbon substituents having from 1 to 20 carbon atoms.

5. The metallocene compound according to claim 4 wherein R^{10} is a linear or branched C_1-C_{20}-alkyl radical; R^{11} is a C_6-C_{40}-aryl, C_7-C_{40}-alkylaryl or C_7-C_{40}-arylalkyl radical or form with R^{12} a phenyl ring that can be substituted with hydrocarbon groups having from 1 to 20 carbon atoms; R^{12} is a hydrogen atoms or form with R^{11} 3-7 membered ring as explained above; R^{14} and R^{13} are hydrogen atoms or C_1-C_{20} alkyl radicals.

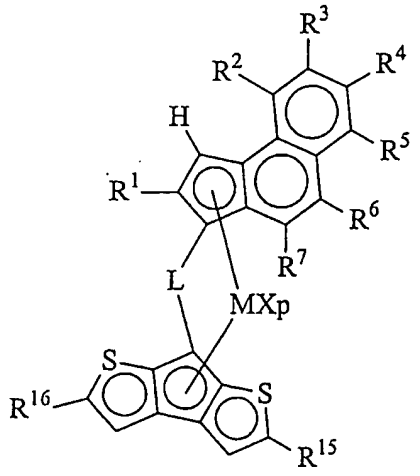
6. The metallocene compound according to claims 4or 5 having formula (III)



(III)

wherein M, X, p, L R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^{10}, R^{13} and R^{14} have the meaning described in claim 1-5.

7. The metallocene compound according to anyone of claims 1-3 having formula (IV)



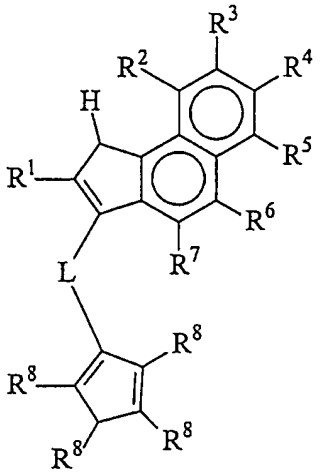
(IV)

wherein M, X, p, L R^1, R^2, R^3, R^4, R^5, R^6 and R^7 have the meaning described in claims 1-3; R^{15} and R^{16}, equal to or different from each other, are hydrogen atoms or C_1-C_{40} hydrocarbon groups optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

8. The metallocene compound according to claim 7 wherein R^{15} and R^{16} are linear or branched C_1-C_{40}-alkyl radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements.

9. A process for preparing a metallocene compound of formula (I) comprising the following steps:

(a) contacting the compound of formula (Ia)



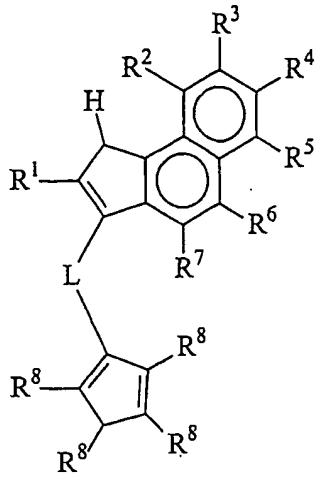
(Ia)

and/or its double bond isomers

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8 and L have the meaning described in claims 1-3 with a base selected from T_jB, $TMgT^1$, sodium and potassium hydride, metallic sodium and potassium, wherein B is an alkaline or alkali-earth metal; and j is 1 or 2, j being equal to 1 when B is an alkaline metal, preferably lithium, and j being equal to 2 when B is an alkali-earth metal; T is a linear or branched, cyclic or acyclic, C_1-C_{20}-alkyl, C_6-C_{20}-aryl, C_7-C_{20}-alkylaryl or C_7-C_{20}-arylalkyl radical, optionally containing one or more Si or Ge atoms; preferably T is methyl or butyl radical; T^1 is an halogen atom or a group OR''' wherein R''' is a linear or branched, cyclic or acyclic, C_1-C_{40}-alkyl, C_6-C_{40}-aryl, C_7-C_{40}-alkylaryl or C_7-C_{40}-arylalkyl radical, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; wherein the molar ratio between said base and the ligand of the formula (Ia) and is at least 2:1; excess of said base can be used; and

b) contacting the product obtained in step a) with a compound of formula MX_{p+2} wherein M, X and p have the meaning described in claims 1-3.

10. A ligand of formula (Ia)

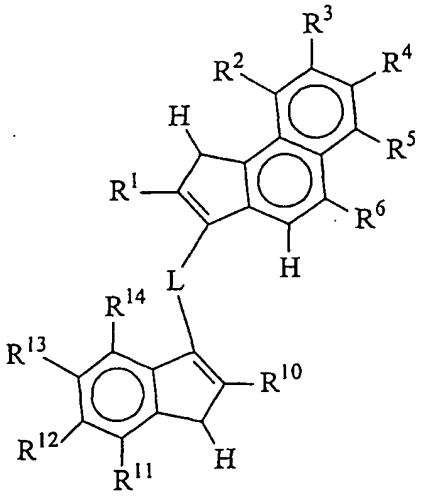


(Ia)

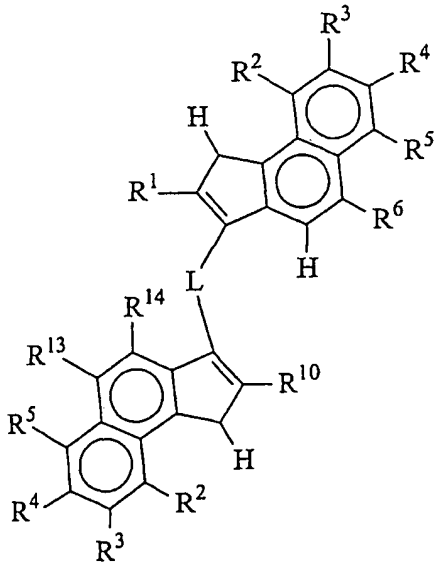
and/or its double bond isomers

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8 and L have the meaning described in claims 1-3.

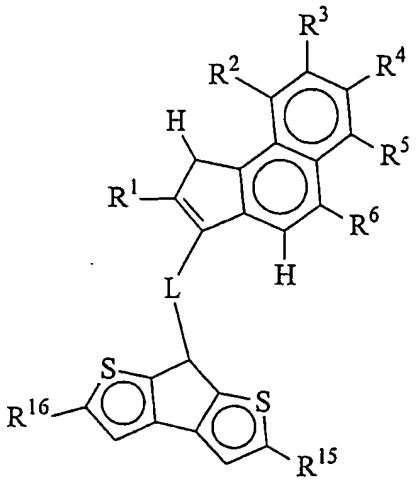
11. The ligand according to claim 12 having formulas (IIa), (IIIa) and (IVa) and/or their double bonds isomers



(IIa)



(IIIa)



(IVa)

wherein L, R^1, R^2, R^3 R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15} and R^{16}, have been described in claims 1-8.

12. A catalyst system obtainable by contacting:
    a) at least a metallocene compound of formula (I);
    b) at least an alumoxane or a compound able to form an alkylmetallocene cation; and
    c) optionally an organo aluminum compound.
13. The catalyst system according to claim 12 wherein the metallocene compound of point a) is selected from the compounds of formulas (II), (III) and (IV).
14. A process for (co)polymerizing olefins containing from 2 to 20 carbon atoms comprising contacting one or more of said olefins under polymerization conditions in the presence of the catalyst system of claims 12 and 13.
15. The process according to claim 14 wherein the olefins are alpha-olefins containing from 2 to 20 carbon atoms.
16. The process according to claim 16 wherein are propylene, ethylene or 1-butene are (co)polymerizated